Electrostatics and Circuits:

Variable	Unit
P	$W = \frac{J}{s}$
E	J
q or Q	C
R	Ω
$\vec{E}$	N/C
V	$V =$
I	$A = \frac{C}{s}$
$\vec{F}$	N
constant: k	$N \cdot m^2/C^2$
r	m
d	m
ΔU_e	J

Find all V's and I's:

$R_1 = 70\,\Omega$

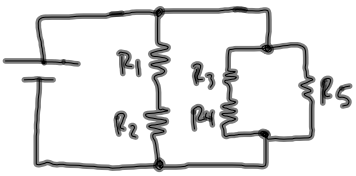
$R_2 = 90\,\Omega$

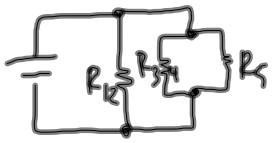
$100\,V$

$R_3 = 110\,\Omega$

$R_4 = 85\,\Omega$

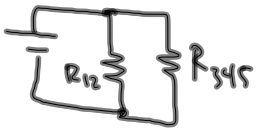
$R_5 = 92\,\Omega$





$R_{12} = 160\,\Omega$

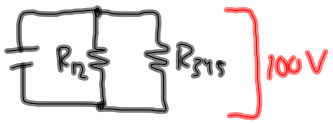
$R_{34} = 195\,\Omega$



$R_{345} = 62.5\,\Omega$

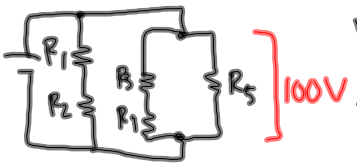
$R_{eq} = 44.9\,\Omega$

$V_{total} = I_{total} R_{eq}$ $\quad I_{total} = \frac{100\,V}{44.9\,A} = 2.23\,A$



$I_{12} = \frac{100\,V}{R_{12}} = 0.625A$

$I_{345} = \frac{100\,V}{R_{345}} = 1.6\,A$

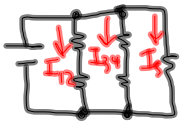


$V_1 = I_{12} R_1 = 43.8\,V$

$V_2 = I_{12} R_2 = 56.2\,V$

$I_5 = \frac{100\,V}{R_5} = 1.09\,A$

equivalent circuits



$I_{total} = I_{12} + I_{34} + I_5$

$I_{34} = 2.2A - 0.625A - 1.09A$

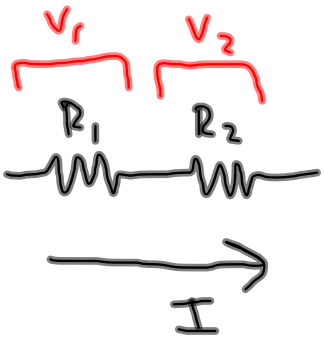
$= 0.51\,A$

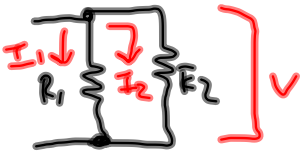
$V_3 = I_{34} R_3$

$= 56.1\,V$

$V_4 = I_{34} R_4$

$= 43.9\,V$





Series connections:

share current

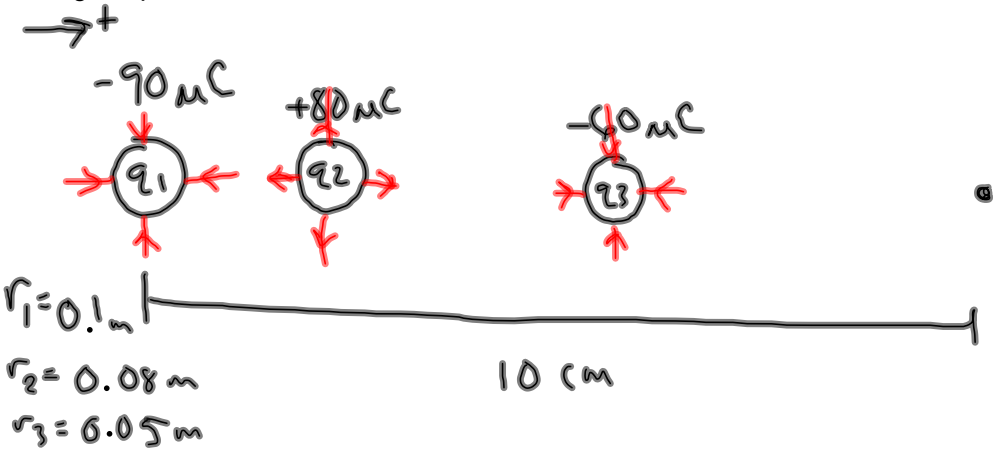
different V's

parallel connections:

share voltage

different I's

Three charges are arranged in a line. Charge 1 has a value of -90 microC and is located at the origin, charge 2 has a value of +80 microC and is located at x = 2 cm, and charge 3 has a value of -60 microC and is located at x = 5 cm.
a) Find the value of the electric field at the point x = 10 cm.
b) If a charge of +50 microC is placed at this point, what is the electric force that the charge experiences?



a) $\bar{E}_{net} = \bar{E}_1 + \bar{E}_2 + \bar{E}_3$

$$= -\frac{k|q_1|}{r_1^2} + \frac{+k|q_2|}{r_2^2} + \frac{-k|q_3|}{r_3^2}$$

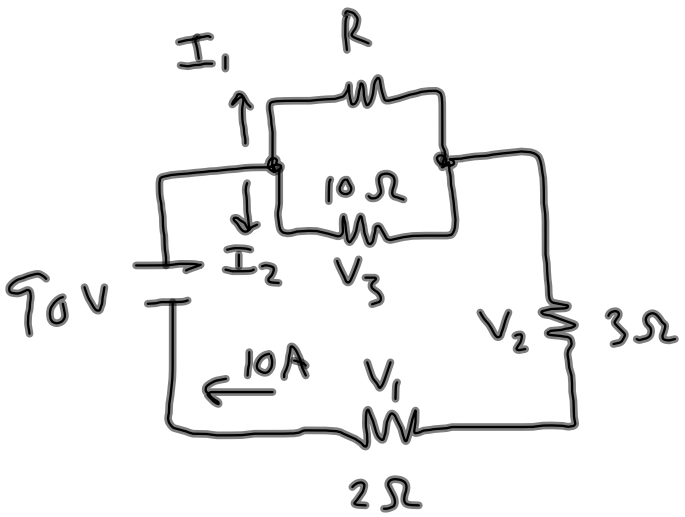
$$= (8.77E9\ N\cdot m^2/C^2)\left[\frac{(90E-6\,C)}{(0.1m)^2} + \frac{(80E-6\,C)}{(.08m)^2} - \frac{(60E-6\,C)}{(.05m)^2}\right]$$

$$= -1.84E8\ N/C$$

b) $\bar{E} = \frac{\bar{F}}{q}$

$$\bar{F} = \bar{E}q = (-1.84E8\ N/C)(+50E-6\,C)$$

$$= -9215\ N$$



R =

V_3 : 40 V

V_2 = 30 V

V_1 = 20 V

I_1 = 6 A

I_2 = 4 A

$I_{total} = 10\,A$

$10\,A = I_1 + I_2$

$V_1 = I_{total}(2\Omega) = 20\,V$

$I_1 = 6\,A$

$V_2 = I_{total}(3\Omega) = 30\,V$

$V_{total} = V_1 + V_2 + V_3 \Rightarrow V_3 = 90V - 20V - 30V$

$= 40\,V$

$I_2 = \frac{V_3}{10\Omega} = 4\,A$